



REPORT HIGHLIGHTS

OFFICE OF CITY AUDITOR – SEATTLE

August 9, 2005

A copy of the Office of City Auditor's full report can be obtained at the office Web site at <http://seattle.gov/audit> or by calling (206) 233-3801. Please direct any questions or comments regarding this report, or suggestions for future audits, to Susan Cohen, Seattle City Auditor, at (206) 233-3801 or susan.cohen@seattle.gov.

CLIMATE CHANGE WILL IMPACT THE SEATTLE DEPARTMENT OF TRANSPORTATION

Scientists have reached a broad consensus that climate change is occurring, that its effects will be dramatic, and that it will pose significant challenges for policymakers. Government leaders around the world have acknowledged that climate change is an increasingly urgent issue. In fact, the importance of climate change was underscored when it was identified as a critical global issue at the

2005 G8 (Group of Eight Industrialized Nations) Summit in Scotland.



More frequent or extreme flooding and landslides could cause extensive property damage, threaten roads and bridges, obstruct transportation corridors, and interrupt public utilities and services.

Photo Source: Seattle Municipal Archives

Although climate change is a global issue, the impacts will occur at the local level.¹

Climate change is already impacting the Pacific Northwest and is likely to have a significant financial impact on the City of Seattle, affecting a wide range of City services, functions, and infrastructure.

Climate change requires action on two fronts:

- *Prevention:* Actions focused on preventing or slowing climate change by reducing human-generated pollutants that worsen climate change, and
- *Adaptation:* Implementation of strategies to effectively adapt to changes in climate.

The City of Seattle has been a national leader in its efforts to prevent climate change, however, the City must continue to develop effective, proactive actions to prepare for and respond to potential changes in climate that affect its operations, services, and assets. The degree to which local governments plan and prepare to respond to or mitigate potential climate change impacts influences their physical and financial vulnerabilities to those impacts.

To assist policymakers in developing adaptive strategies, the Office of City Auditor initiated a series of reviews on how changes in the Pacific Northwest region's climate will impact various City departments. This first review focused on the Seattle Department of Transportation's (SDOT) operations, services, and infrastructure that could be significantly impacted by anticipated changes in the region's climate. Our review focused on primary impacts of climate change, such as warmer temperatures, rising sea levels, and increased winter precipitation.

¹ Amy Snover, Ph.D., University of Washington Climate Impacts Group

Five Transportation Areas Are Likely to Be Impacted by Climate Change

Flooding and Landslides

Climate change is expected to cause increased winter precipitation and more frequent flood and landslide events in Seattle. Seattle has experienced two incidents of 100-year storms during the past eight years. Major storms during the winter of 1996-1997 caused more than 70 landslides with

damage costs of \$20 million. SDOT estimates departmental emergency response costs at approximately \$25,000 per event.

SDOT, in coordination with Seattle Public Utilities, would need to consider three related issues if more frequent landslide and flooding incidents occur: (1) the adequacy of existing drainage system capacity and design standards; (2) potential damage to roadway structures; and (3) impacts on water quality.

Seawall Conditions

Climate change could cause rising sea levels and coastal inundation. Design standards for the Alaskan Way Seawall replacement appropriately recognize that sea level will increase during the 21st century. However, sea level projections from the University of Washington climate research group suggest that the City's current design standards for the new seawall may not adequately account for the potential projected rise in sea level.



Rising sea levels could result in coastal inundation and impact land adjacent to major bodies of salt water.

Photo Source: Seattle Municipal Archives

Consulting engineers for the new seawall analyzed historical sea level data and predicted tide elevations for the structure's planned (design) life, and indicated that the design of the new seawall should accommodate a 0.9 foot rise in sea level over a 75-year time period, while the University of Washington Climate Impacts Group indicated that this figure appears to be underestimated, and instead projected a rise of 1.0 to 2.8 feet over a 75-year period.

Bridge Conditions

Climate change could impact Seattle's bridge conditions as warmer temperatures cause greater thermal expansion. Structures may require increased ongoing maintenance if thermal expansion is not considered and accounted for adequately. If climate change causes temperatures to increase significantly, SDOT's work crews may need to perform additional maintenance work to address increased expansion.



Erosion could be problematic around bridges with shallower footings.

Photo Source: Seattle Department of Transportation

SDOT management indicated that warmer temperatures could already be affecting the operations of some Seattle bridges.

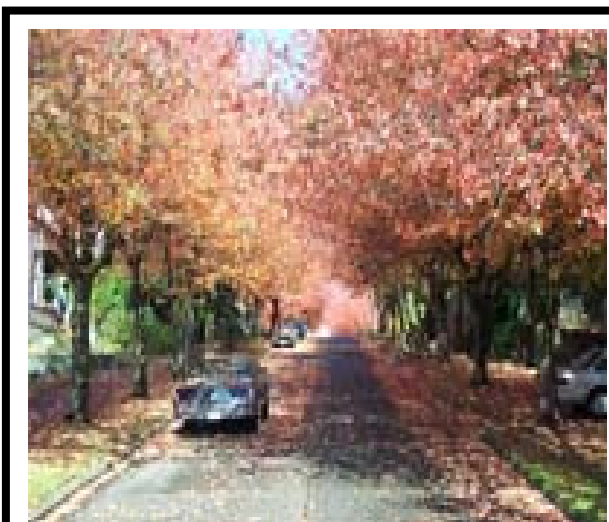
Roadway Conditions

Increased winter rainfall and warmer temperatures could cause an increase of potholes and the cracking and buckling of paved surfaces, according to some SDOT managers.

The potential for climate change to cause more rapid roadway deterioration could make it even more important to perform adequate ongoing maintenance on older streets and minimize repair backlogs. Increased rainfall could also cause more frequent or severe street flooding, which would impair mobility Seattle's street mobility.

Urban Forestry

Climate change will likely result in increased maintenance requirements for landscaped areas; impacts on private and public development; and impacts on fish habitat and water quality. Seattle may already be experiencing the impacts of climate change and should plan a response. The last two summers have been dry, long, and hot, endangering the health of many plants and trees in Seattle.



Climate change is likely to increase stress on City trees and landscaped areas, requiring increased maintenance to preserve the City's investment.

Photo Source: Seattle Department of Transportation

SDOT maintains an inventory of 130 acres of land in City rights-of-way. The total green infrastructure (trees and other landscaping), excluding the land, is valued at approximately \$130 million.

Additional resources to provide and support landscaped areas could be needed to effectively address potential climate change impacts to the City's urban forest.

SDOT Is Beginning to Incorporate Climate Trends in Long-Range Planning

The Seattle Department of Transportation (SDOT) is currently considering climate-related trends with regard only to urban forestry and the design standards for the new Alaskan Way Seawall. SDOT has not yet considered climate change with regard to other infrastructure and operations. Division directors and managers recognize that climate change impacts will need to be considered in long-term planning and in future decisions.

Recommendations

We recommended that the following issues be considered:

Alaskan Way Seawall Replacement. The City should obtain a comprehensive, independent analysis that considers all available scientific sources to estimate the increase in sea level and the rate of the increase on a probability basis to determine whether the standards for the seawall replacement design sufficiently address the projected sea level rise.

Long-Range Planning. SDOT needs a substantive technical study to identify, prioritize, and quantify potential climate change impacts, and to plan appropriate responses. The department needs to incorporate regional climate change in long-term transportation planning.

Interdepartmental Team on Climate Change. The Executive should form an interdepartmental and regional team to assess climate change impacts and ensure the consistent use of scientific projections and data in developing City standards, policies, and long-range plans.

Climate Change Is Already Impacting the Northwest

- The Cascades snowpack, which the region depends on for drinking water, hydroelectricity, recreation, fish habitat, and irrigation, has declined substantially since 1950.
- Seattle experienced two incidents of 100-year storms in the last eight years.
- Washington's governor declared a statewide drought emergency in March 2005 with water levels for many Washington rivers at or near record lows.
- Washington and Oregon ski resorts closed in early 2005 because of insufficient snow.
- Warm water temperatures may be responsible for the disappearance of as many as 200,000 sockeye between the Locks and their spawning grounds in streams beyond Lake Washington.

Boston Study Suggests That the Financial Impact of Climate Change Will Be Substantial for Local Jurisdictions

A policy and engineering research team concluded that climate change could impact facilities, emergency services, and energy prices in the Boston metropolitan area that could cost \$94 billion during the next 100 years. The "Climate's Long-Term Impact on Metro Boston" (CLIMB) study indicated that the most costly approach for Boston and other cities is the "Ride It Out" approach, in which no proactive steps are taken to prepare or respond to potential climate change impacts. In this scenario, funding would be used to respond to problems as they occur. According to the study, the best approach would be the "Green" approach, in which officials immediately begin to revise standards, plans, and projects, and design and build based on the revised standards as existing infrastructure deteriorates.

The CLIMB study can be found at the following Web site: <http://www.tufts.edu/tie/climb/>